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Mapping, in digital musical instruments

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A digital musical instrument (DMI) can be defined as an instrument that contains a control surface (also referred to as a performance controller, or hardware interface, an input or gesture device, the latest being more used outside the strict field of Computer Music) and a sound generation unit. Both units are independent modules related to each other by mapping strategies [Miranda and Wanderley, 2006]. The sound generation unit most commonly consists of signal-based synthesis algorithms generated by a computer, including additive, subtractive, FM synthesis, physical modelling, sampling synthesis, etc. In this item we focus on mapping strategies and their influence on the design of and performance with DMIs.

This modular structure extends the possibilities for musical interaction above and beyond that which is provided by acoustic musical instruments, thus enabling innovative musical uses. Musicians now have the opportunity to choose the gesture controller from any existing input device or a novel controller designed from scratch, choose a sound synthesis technique, and to relate both through specific mapping techniques. In light of this, the mapping stage is responsible for filling the ontological gap between the gestures performed by the user (or more precisely the gesture signals), and the parameters of the sound processes.

Mapping therefore is a strong determinant of the behaviour of a given DMI: in short, it strongly contributes the essence of the instrument [Hunt et al., 2003]. As such the choice and building of an appropriate strategy is difficult, in particular because there may be no model on which to base its design (when, for instance, the DMI has no acoustic basis such as an existing instrument). Other difficulties may arise due to the fact that various input parameters often must be varied in correlation in order to approach sufficiently subtle variations in the sounds and obtain a consistent effect on perception [Verfaille et al., 2006]. This is especially the case when the real time sound process is a signal-based synthesis model (loudness has to be varied along with spectrum, fundamental frequency along with level of harmonicity, etc.).

In DMI design, mapping has been approached from various directions, and as a result different properties become more or less salient. Indeed, depending on the design critera, mapping can manifest as an interpolation or extrapolation between parameters or states, as a static or dynamic multi-parametric function that may be explicit (described analytically) or implicit (adapted through training), static or dynamic, continuous or discrete, composed of several layers of mapping between intermediate parameter sets, etc. The mapping may possess further properties depending on the chosen controller, sound synthesis and the underlying interaction context.

Indeed, generalizing the mapping concept allows potentially letting *any* parameter in the sound model, and (at least) theoretically any conceivable quality of sound to become playable. Hence, for example, through an appropriate mapping strategy, the performer becomes able to play (with) - to "interpret" - sound spatialisation effects (localisation, room effects), level of harmonicity in the sound, timbre, rhythm of a loop, morphing between sounds, etc. Indeed, as says [Risset, 1999], new DMI "*freed the musician from the mechanical constraints*".

A second evolution one can observe today is that musicians (both composers and performers) now have the ability to directly define and adjust the behaviour of the instrument. Hence, not only the mapping concept allows playing dimensions of the sound that were not accessible with traditional instruments, but the mapping itself becomes "playable", adaptable, etc.

Both because the design of appropriate mapping strategies is known to be difficult, and because (as discussed) the concept of mapping and its generalisation in the case of novel DMIs possesses numerous substantial benefits, the research focused on mapping [VanNort et al., 2007] and the systems that aid in designing mappings [Malloch et al., 2007] is developing rapidly today in the field of computer music.

However, despite its many interests, one should note that the concept of mapping is not the unique, nor definitive, solution toward expressive digital instruments. The item "mapping and control vs. instrumental interaction" provides a possible critique of the mapping concept [→ Mapping and control vs. instrumental interaction].

References

[Hunt et al., 2003] A Hunt, M Wanderley and M Paradis : "The Importance of Paramter Mapping in Electronic Instrument Design", Journal of New Music Research, 32(4), pp. 429-440, 2003.

[Malloch et al, 2007] Joseph Malloch, Stephen Sinclair, and Marcelo M. Wanderley : "From Controller to Sound: tool for collaborative development of digital musical instruments" – in Proceedings of the International Computer Music Conference– ICMC 2007 – august, 2007, Copenhagen, Danmark.

[Risset, 1999] Risset JC : "Evolution des outils de création sonore" – in Interfaces homme-machine et création musicale – sous la direction de H Vinet et F Delalande – Hermès, 1999.

[VanNort et al., 2007] Doug Van Nort, Marcelo Wanderley "Control Strategies for navigation of Complex Sonic Spaces", in Proceedings of the International Conference on New Interfaces for Musical Expression – NIME 07 - New York, June 6th - 10th, 2007

[Verfaille et al, 2006] V Verfaille : "Mapping strategies for gestural and adaptive control of digital audio effects", Journal of New Music Research, 35(1), pp. 71-93, 2006.

[Wanderley et al., 2004] M Wanderley and P Depalle: "Gestural Control of Sound Synthesis", Proceedings of the IEEE, 2004.

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